

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of	)	
	)	GN Docket No. 17-183
Expanding Flexible Use in Mid-Band	)	
Spectrum between 3.7 and 24 GHz	)	

**REPLY COMMENTS OF IEEE 802.11**

November 15, 2017

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## **I. INTRODUCTION**

IEEE 802.11 respectfully submits these reply comments to the FCC (“the Commission”) in the above-mentioned proceeding. IEEE 802 is a leading consensus-based industry standards body. It produces standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless specialty networks (“WSNs”), wireless metropolitan area networks (“WMANs”), and wireless regional area networks (“WRANs”). This document solely represents the views of the IEEE 802.11 Working Group and does not necessarily represent a position of either the IEEE, the IEEE Standards Association, or IEEE 802. We appreciate the opportunity to provide these comments to the Commission.

## **II. IEEE 802.11 Has a Long History of Producing Successful Coexistence Between Different Technologies**

FCC rules require unlicensed technologies to avoid causing harmful interference to licensed services and to accept interference from both licensed services and other unlicensed operations.<sup>1</sup> Consequently, the unlicensed technology community, through the 802.11 standards process, has innovated and adapted to ensure that unlicensed devices can deliver extraordinary value while complying with these rules in a variety of interference contexts. This adaptability, and the fact that sharing and incumbent protection is built into the core of 802.11 standards, is one of the great strengths of unlicensed technologies and has enabled these technologies to produce the enormous economic value seen today.

The initial and ongoing success of 802.11 technologies in the 2.4 GHz band in the United States, is a prime example of this strength. This band is home to a vast range of technologies, both IEEE and non-IEEE based. To prosper in this band, IEEE 802.11 – working through established IEEE 802 processes – successfully developed coexistence mechanisms to advance

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<sup>1</sup> 47 C.F.R. § 15.5.

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sharing between these different unlicensed technologies. For example, the individual Working Groups responsible for Wi-Fi (802.11), Bluetooth (802.15.1), and Zigbee (802.15.4) have collaborated for nearly two decades to ensure that they can operate in close proximity. This is no accident. It is due to hard work in the standard setting context and careful engineering that advances and executes IEEE compromises. The success of this industry-led model permits the FCC to rely on a less-regulatory and less-heavy-handed approach which spurs innovation and investment.

Furthermore, 802.11 technologies successfully adapted to a completely different environment in the U-NII-2a and U-NII-2c bands in 5 GHz. Here, because of the need to protect government radar systems, unlicensed devices have evolved to incorporate the Dynamic Frequency Selection (“DFS”) mechanisms required by Commission rules.<sup>2</sup> Because unlicensed devices have the flexibility to incorporate DFS, they have successfully increased overall use of these bands while protecting government radar incumbents. In fact, the Commission recently recognized DFS’s effective protection of such incumbents when it amended its rules to more completely protect weather radar operators, critically important users of the band.<sup>3</sup> Government and private-sector engineers developed DFS detection to address the specific interference-protection needs of government radar systems. However, detection alone is incomplete. DFS requires a control plane to allow for signaling of regulatory requirements to stations, channel quieting, and graceful movement of stations from impacted channels. IEEE 802.11 developed the technical standards that create a complete solution for radar avoidance, beginning with 802.11h-2003 and spanning several other amendments. Nonetheless, its successful protection of incumbents in U-NII-2a and U-NII-2c demonstrates the flexibility of 802.11 technologies.

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<sup>2</sup> *Id.* at § 15.407(h)(2).

<sup>3</sup> *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, 29 FCC Rcd. 4127 ¶¶ 67, 70 (2014).

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Notably, while the Commission found that some individual rogue unlicensed operators had improperly disabled DFS or used non-compliant devices in the band in violation of Commission rules, the Agency's recent addition of security mechanisms and its enforcement activity have addressed these incidents.<sup>4</sup> It would be incorrect to assert that the activities of these individual rule violators is evidence that the Commission's DFS rules do not work—just as it would be incorrect to assert that the existence of pirate broadcasters is evidence that the Commission's broadcast rules do not work. The Commission should reject such an argument.<sup>5</sup>

More recently, the millimeter bands have brought their own set of coexistence challenges. In the 60 GHz band, IEEE 802.11ad developed coexistence mechanisms with respect to the 802.15.3c Wireless Personal Area Network (WPAN) standard that preceded it in 2009. These mechanisms included channelization design, a detection technique and as many as eight different potential mitigations that may be employed in response to the presence of these devices.<sup>6</sup> IEEE is well positioned to address interference concerns raised by any stakeholders in the 6 GHz band just as it has in the 2.4 GHz and 5 GHz bands, and the FCC should not change its time-tested approach for addressing such interference.

### **III. The Record Demonstrates Strong Support for an NPRM Proposing Rules that Protect Existing Licensees**

The Commission, drawing on the flexibility of the 802.11 technologies described above, should move ahead with a NPRM proposing to permit unlicensed operations throughout the 6 GHz band—from 5.925-7.125 GHz. The record includes comments from equipment manufacturers,

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<sup>4</sup> *Id.* at § 15.407(i).

<sup>5</sup> See Comments of IEEE Broadcast Technology Society at 4, GN Docket No. 17-183 (filed Oct. 2, 2017).

<sup>6</sup> IEEE 802.11ad-2012, *Enhancements for Very High Throughput in the 60 GHz Band*, at clause 10.34 (DMG coexistence with non-IEEE-802.11 systems), <http://ieeexplore.ieee.org/document/6392842/?reload=true>.

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radio companies, chipmakers, network providers, and even 6 GHz incumbents supporting an engineering-driven process at the FCC to explore how unlicensed devices can protect incumbent operations.<sup>7</sup>

IEEE 802.11 has decades of experience addressing such inquiries. Based on this experience, we recommend that the Commission propose interference-protection rules that are tailored to the different interference environments present in the 6 GHz band. We recommend that the Commission consider rules that employ a mix of maximum-power restrictions, transmit power control, antenna pointing, geolocation, and beaconing. In addition, it should consider outdoor-use restrictions if absolutely necessary for particular sub-bands, because building attenuation will ensure that indoor use of unlicensed devices is unlikely to pose a significant interference risk for incumbents. As discussed above, IEEE 802.11 technologies are flexible enough to incorporate each of these interference-control mechanisms. But the Commission should only impose regulations requiring the use of one of these mechanisms where technical analysis demonstrates that they are necessary, because they increase equipment costs and limit deployment flexibility.

A sub-set of 6 GHz incumbents ask the Commission to block any unlicensed operations in the band, no matter what interference-control mechanisms they employ. Such a draconian approach is unnecessary and ignores the strong evidence of the ability of IEEE 802.11 technologies to effectively protect incumbent operations. Blocking unlicensed technologies would foreclose access to one of the only frequency bands practically available to address the

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<sup>7</sup> See, e.g., Comments of Broadcom Ltd at 25, GN Docket No. 17-183 (filed Oct. 2, 2017).; Comments of Hewlett Packard Enterprise Company at 14, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of CTIA at 16, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of Google LLC and Alphabet Access at 13, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of Intel Corporation at 6, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of the Mid-Band Spectrum Coalition at 14, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of Nokia at 16, GN Docket No. 17-183 (filed Oct. 2, 2017).

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well-documented and pressing need for additional spectrum for Wi-Fi and other unlicensed technologies.<sup>8</sup> This would be a major blow to growth of and investment in Wi-Fi—the primary on-ramp for the Internet—to the detriment of consumer broadband access, enterprise wireless, and expansion of the Internet of Things.

#### **IV. Conclusion**

The history of IEEE 802.11, and the success of the technologies using the standards it has developed, are a testament to the ability of creative engineers' ability to solve spectrum co-existence challenges. The Commission's NOI is a recognition of the potential of unlicensed technologies' ability to expand the economy and drive innovation in the 6 GHz band. IEEE 802.11 respectfully suggests that the Commission now take the next step and address the nation's unlicensed spectrum challenge by adopting an NPRM that proposes to permit unlicensed operations throughout the 6 GHz band, and that requests engineering studies on appropriate interference-protection mechanisms.

Respectfully submitted,

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<sup>8</sup> See generally Raul Katz, Telecom Advisory Servs., LLC, *Assessment of the Future of Economic Value of Unlicensed Spectrum in the United States* (2014); Rolf de Vegt et al., Qualcomm Techs., Inc., *A Quantification of 5 GHz Unlicensed Band Spectrum Needs* (2017).